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PROFESSOR ALDINI'S
GALVANIC EXPERIMENTS.

*To The Medical Society
of London.*

*With the Author's
respectful compliments, and
gratitude*

The Gift of
Professor Aldini.



AN ACCOUNT

OF THE

GALVANIC EXPERIMENTS

PERFORMED BY

JOHN ALDINI,

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MEMBER OF THE MEDICAL AND GALVANIC SOCIETIES OF PARIS;

OF THE MEDICAL SOCIETY OF LONDON; AND

OF THE SOCIETY OF PHYSICIANS

AT GUY'S HOSPITAL:

&c. &c.

ON THE BODY OF A MALEFACTOR

EXECUTED AT NEWGATE

JAN. 17, 1803.

WITH

A SHORT VIEW OF SOME EXPERIMENTS WHICH
WILL BE DESCRIBED IN THE AUTHOR'S
NEW WORK NOW IN THE PRESS.

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1803.



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TO
THOMAS KEATE, ESQ. F.R.S.
SURGEON-GENERAL TO THE BRITISH FORCES,
MASTER OF THE ROYAL COLLÈGE
OF SURGEONS, &c. &c. &c.

SIR,

IT is with the highest satisfaction
that I do myself the honor of
dedicating this account of Expe-
riments, undertaken for the ad-
vancement of the welfare of the
human race, to you, Sir, who
have so eminently exerted your
talents in the same cause, and are
so

so worthily placed at the head of a great establishment characterized by its public spirit and benevolence. This new and arduous undertaking was necessarily attended with difficulties of no inconsiderable magnitude, but the sanction and approval of that learned body, several of the members of which so obligingly assisted in the experiments, enabled me to overcome every obstacle. I beg you, Sir, to accept this public testimony of the sense I entertain of the liberal conduct which has distinguished the Royal College of Surgeons and
yourself;

yourself; and request you will have the goodness to convey to them the most sincere acknowledgments of my gratitude and respect.

I have the honor to be,

Sir,

Your much obliged,

And very humble servant,

JOHN ALDINI.

Feb. 5, 1803.

His very hopes are blasted
at present at London, and yet
-wishes to see it soon, and
his family are so anxious
for him.

..... Gaudet mors succurrere vitæ.

He is now in the
-wishes to see it soon, and
his family are so anxious
for him.

AN ACCOUNT
OF
GALVANIC EXPERIMENTS,
&c. &c.

INTRODUCTION.

THE unenlightened part of mankind are apt to entertain a prejudice against those, however laudable their motives, who attempt to perform experiments on dead subjects; and the vulgar in general even attach a sort of odium to the common practice of anatomical dissection. It is, however, an incontrovertible fact, that such researches in modern times have proved a source of the most

valuable information, in regard to points highly interesting to the knowledge of the human frame, and have contributed in an eminent degree to the improvement of physiology and anatomy. Enlightened legislators have been sensible of this truth ; and therefore it has been wisely ordained by the British laws, which are founded on the basis of humanity and public benefit, that the bodies of those who during life violated one of the most sacred rights of mankind, should after execution be devoted to a purpose which might make some atonement for their crime, by rendering their remains beneficial to that society which they offended.

In consequence of this regulation, I lately had an opportunity of performing

forming some new experiments, the principal object of which was to ascertain what opinion ought to be formed of Galvanism as a mean of excitement in cases of asphyxia and suspended animation. The power which exists in the muscular fibre of animal bodies some time after all other signs of vitality have disappeared, had before been examined according to the illustrious Haller's doctrine of irritability; but it appeared to me that muscular action might be excited in a much more efficacious manner by the power of the Galvanic apparatus.

In performing these experiments, I had another object in view. Being favoured with the assistance and support of gentlemen eminently well skilled in the art of dissection, I pro-

posed, when the body should be opened, to perform some new experiments which I never before attempted, and to confirm others which I had made above a year ago on the bodies of two robbers decapitated at Bologna.

To enlarge on the utility of such researches, or to point out the advantages which may result from them, is not my object at present. I shall here only observe, that as the bodies of valuable members of society are often found under similar circumstances, and with the same symptoms as those observed on executed criminals, by subjecting the latter to proper experiments, some speedier and more efficacious means than any hitherto known, of giving relief in such cases, may, perhaps, be discovered.

discovered. In a commercial and maritime country like Britain, where so many persons, in consequence of their occupations at sea, on canals, rivers, and in mines, are exposed to drowning, suffocation, and other accidents, this object is of the utmost importance in a public view, and is intitled to every encouragement.

Forster, on whose body these experiments were performed, was twenty-six years of age, seemed to have been of a strong, vigorous constitution, and was executed at Newgate on the 17th of January, 1803. The body was exposed for a whole hour in a temperature two degrees below the freezing point of Fahrenheit's thermometer; at the end of which long interval it was conveyed to a house not far distant, and, in pursuance of
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the sentence, was delivered to the College of Surgeons. Mr. Keate, master of that respectable society, having been so kind as to place it under my direction, I readily embraced that opportunity of subjecting it to the Galvanic stimulus, which had never before been tried on persons put to death in a similar manner: and the result of my experiments I now take the liberty of submitting to the public.

Before I conclude this short introduction, I consider it as my duty to acknowledge my obligations to Mr. CARPUE, lecturer on anatomy, and Mr. HUTCHINS, a medical pupil, for the assistance they afforded me in the dissection. I was also much indebted to Mr. CUTHBERTSON, an eminent mathematical instrument maker,

maker, who directed and arranged the Galvanic apparatus. Encouraged by the aid of these gentlemen, and the polite attention of Mr. KEATE, I attempted a series of experiments, of which the following is a brief account.

EXPE-

EXPERIMENT I.

ONE arc being applied to the mouth, and another to the ear, wetted with a solution of muriate of soda (common salt), Galvanism was communicated by means of three troughs combined together, each of which contained forty plates of zinc, and as many of copper. On the first application of the arcs the jaw began to quiver, the adjoining muscles were horribly contorted, and the left eye actually opened.

EXPERIMENT II.

ON applying the arc to both ears, a motion of the head was manifested,
and

and a convulsive action of all the muscles of the face: the lips and eyelids were also evidently affected; but the action seemed much increased by making one extremity of the arc to communicate with the nostrils, the other continuing in one ear.

EXPERIMENT III.

THE conductors being applied to the ear, and to the rectum, excited in the muscles contractions much stronger than in the preceding experiments. The action even of those muscles furthest distant from the points of contact with the arc was so much increased as almost to give an appearance of re-animation.

EXPERIMENT IV.

IN this state, wishing to try the power of ordinary stimulants, I applied *volatile alkali* to the nostrils and to the mouth, but without the least sensible action: on applying Galvanism great action was constantly produced. I then administered the Galvanic stimulus and volatile alkali together; the convulsions appeared to be much increased by this combination, and extended from the muscles of the head, face, and neck, as far as the *deltoid*. The effect in this case surpassed our most sanguine expectations, and vitality might, perhaps, have been restored, if many circumstances had not rendered it impossible.

EXPE-

EXPERIMENT V.

I NEXT extended the arc from one ear to the *biceps flexor cubiti*, the fibres of which had been laid bare by dissection. This produced violent convulsions of all the muscles of the arm, and especially in the *biceps* and the *coraco brachialis*, even without the intervention of salt water.

EXPERIMENT VI.

AN incision having been made in the wrist, among the small *filaments* of the *nerves* and *cellular membrane*, on bringing the arc into contact with this part, a very strong action of the muscles of the fore-arm and hand

was immediately perceived. In this, as in the last experiment, the animal moisture was sufficient to conduct the Galvanic stimulus without the intervention of salt water.

EXPERIMENT VII.

THE short muscles of the thumb were dissected, and submitted to the action of the Galvanic apparatus, which induced a forcible effort to clench the hand.

EXPERIMENT VIII.

THE effects of Galvanism in this experiment were compared with those of other stimulants. For this purpose,

pose, the point of the scalpel was applied to the fibres, and even introduced into the substance of the *biceps flexor cubiti* without producing the slightest motion. The same result was obtained from the use of *caustic volatile alkali* and *concentrated sulphuric acid*. The latter even corroded the muscle, without inducing it to action.

EXPERIMENT IX.

HAVING opened the *thorax* and the *pericardium*, exposing the heart *in situ*, I endeavoured to excite action in the *ventricles*, but without success. The arc was first applied upon the surface, then in the substance of the fibres, to the *carneæ columnæ*, to the
septum

septum ventriculorum, and lastly, in the course of the nerves by the *coronary arteries*, even with salt water interposed, but without the slightest visible action being induced.

EXPERIMENT X.

IN this experiment the arc was conveyed to the *right auricle*, and produced a considerable contraction, without the intervention of salt water, but especially in that part called the *appendix auricularis*: in the left auricle scarcely any action was exhibited.

EXPERIMENT XI.

CONDUCTORS being applied from the spinal marrow to the fibres of the
biceps

biceps flexor cubiti, the *gluteus maximus*, and the *gastrocnemius*, separately, no considerable action in the muscles of the arm and leg was produced.

EXPERIMENT XII.

THE *sciatic nerve* being exposed between the *great trochanter of the femur* and the *tuberosity of the ischium*, and the arc being established from the *spinal marrow* to the *nerve* divested of its *theca*, we observed, to our astonishment, that no contraction whatever ensued in the muscles, although salt water was used at both extremities of the arc. But the conductor being made to communicate with the *fibres of the muscles* and the *cellular membrane*, as strong an action as before was manifested.

EXPE-

EXPERIMENT XIII.

By making the arc to communicate with the *sciatic nerve* and the *gastrocnemius* muscle, a very feeble action was produced in the latter.

EXPERIMENT XIV.

CONDUCTORS being applied from the *sciatic* to the *peroneal nerve*, scarcely any motion was excited in the muscles.

EXPERIMENT XV.

THE *sciatic nerve* being divided about the middle of the thigh, on applying the conductors from the *biceps flexor*

flexor cruris to the *gastrocnemius*, there ensued a powerful contraction of both. I must here observe that the muscles continued excitable for seven hours and a half after the execution. The troughs were frequently renewed, yet towards the close they were very much exhausted. No doubt, with a stronger apparatus we might have observed muscular action much longer; for, after the experiments had been continued for three or four hours, the power of a single trough was not sufficient to excite the action of the muscles; the assistance of a more powerful apparatus was required. This shows that such a long series of experiments could not have been performed by the simple application of metallic coatings. I am of opinion that, in general,

these coatings, invented in the first instance by Galvani, are passive. They serve merely to conduct the fluid pre-existent in the animal system; whereas, with the Galvanic batteries of Volta, the muscles are excited to action by the influence of the apparatus itself.

FROM the above experiments there is reason to conclude :

I.

That Galvanism, considered by itself, exerts a considerable power over the nervous and muscular systems, and operates universally on the whole of the animal œconomy.

II.

That the power of Galvanism, as a stimulant, is stronger than any mechanical action whatever.

III.

III.

That the effects of Galvanism on the human frame differ from those produced by electricity communicated with common electrical machines.

IV.

That Galvanism, whether administered by means of troughs, or piles, differs in its effects from those produced by the simple metallic coatings employed by Galvani.

V.

That when the surfaces of the nerves and muscles are armed with metallic coatings, the influence of the Galvanic batteries is conveyed to a greater number of points, and acts with considerably more force in producing contractions of the muscular fibre.

VI.

That the action of Galvanism on the heart is different from that on other muscles. For, when the heart is no longer susceptible of the Galvanic influence, the other muscles remain still excitable for a certain time. It is also remarkable that the action produced by Galvanism on the auricles is different from that produced on the ventricles of the heart, as is demonstrated in Experiment the tenth.

VII.

That Galvanism affords very powerful means of resuscitation in cases of suspended animation under common circumstances. The remedies already adopted in asphyxia, drowning, &c. when combined with the influence

influence of Galvanism, will produce much greater effect than either of them separately.

To conclude this subject, it may be acceptable to the reader to have a short but accurate account of the appearances exhibited on the dissection of the body, which was performed with the greatest care and precision by Mr. Carpue.—“ The
 “ blood in the head was not extravasated, but several vessels were prodigiously swelled, and the lungs
 “ were entirely deprived of air; there
 “ was a great inflammation in the intestines, and the bladder was fully
 “ distended with urine. In general,
 “ upon viewing the body, it appeared that death had been immediately

“diately produced by a real suffocation.”

It may be observed, if credit can be given to some loose reports, which hitherto it has not been in our power to substantiate, that after this man had been for some time suspended, means were employed with a view to abridge his sufferings, by accelerating his death.

From the preceding narrative it will be easily perceived that our object in applying the treatment here described was not to produce re-animation, but merely to obtain a practical knowledge how far Galvanism might be employed as an auxiliary to other means in attempts to revive persons under similar circumstances.

In cases when suspended animation has been produced by natural causes, it is found that the pulsations
of

of the heart and arteries become totally imperceptible; therefore, when it is to be restored, it is necessary to re-establish the circulation throughout the whole system. But this cannot be done without re-establishing also the muscular powers which have been suspended, and to these the application of Galvanism gives new energy.

I am far from wishing to raise any objections against the administration of the other remedies which are already known, and which have long been used. I would only recommend Galvanism as the most powerful mean hitherto discovered of *assisting* and increasing the efficacy of every other stimulant.

Volatile alkali, as already observed, produced no effect whatever on
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the body when applied alone ; but, being used conjointly with Galvanism, the power of the latter over the nervous and muscular system was greatly increased ; nay, it is possible that volatile alkali, owing to its active powers alone, might convey the Galvanic fluid to the brain with greater facility, by which means its action would become much more powerful in cases of suspended animation. The well known method of injecting atmospheric air ought not to be neglected ; but here, likewise, in order that the lungs may be prepared for its reception, it would be proper previously to use Galvanism, to excite the muscular action, and to assist the whole animal system to resume its vital functions. Under this view, the experiments of
which

which I have just given an account, may be of great public utility.

It is with heartfelt gratitude that I recall to mind the politeness and lively interest shown by the members of the College of Surgeons in the prosecution of these experiments. Mr. KEATE, the master, in particular proposed to make comparative experiments on animals, in order to give support to the deductions resulting from those on the human body. Mr. BLICHE observed that on similar occasions it would be proper to immerse the body in a warm salt bath, in order to ascertain how far that powerful and extended coating might promote the action of Galvanism on the whole surface of the body. Dr. PEARSON recommended oxygen gas to be substituted in-

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stead

stead of the atmospheric air blown into the lungs. It gives me great pleasure to have an opportunity of communicating these observations to the public, in justice to the eminent characters who suggested them, and as an inducement to physiologists not to overlook the minutest circumstance which may tend to improve experiments that promise so greatly to relieve the sufferings of mankind.

AN

EXTRACT

FROM

MR. NICHOLSON'S JOURNAL,

RESPECTING SOME LATE

GALVANIC EXPERIMENTS,

WHICH WILL BE GIVEN IN THE AUTHOR'S WORK ON
THAT SUBJECT, NOW IN THE PRESS *.

“M. ALDINI, Professor at the Institute of Bologna, and nephew of the celebrated Galvani, after having made his experiments at the National Institute of France, has visited London, and given an accurate account of his experiments and discoveries to the Royal Society, before whom the same was read on the 25th last. I have the pleasure to communicate some of the principal facts which

* Subscriptions for this Work, and for a History of Galvanism, by the same Author, will be received by Cuthell and Martin, Holborn.

he has had the goodness to communicate to me, which appear calculated to throw much light on some of the most difficult phænomena of nature.

“ Various philosophers have considered the metals as not absolutely necessary for the production of Galvanism, and Mr. Davy has proved it in the pile: It has also been indistinctly apprehended or conjectured in the way of theory, that the Galvanic or electric matter was excited, collected, or generated in the bodies of animals, where it was considered as the great cause or instrument of muscular motion, sensation, and other effects highly interesting, but very little understood. Professor Aldini has the distinguished merit of having placed this proposition in the rank of established truths. He has succeeded in exciting muscular contractions by the simple application of the nerves to the muscles of a prepared frog, without the least suspicion of any stimulus arising from contact. He has also given motion to
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the limbs of a small cold-blooded animal by the Galvanic energy of an animal with warm blood; an experiment never before imagined. He takes the head of an ox recently cut off, and applying the finger of one hand, wetted with salt water, to the spinal marrow, he holds in the other hand the muscle of a frog prepared (that is by dissection) in such a direction that its crural nerves shall touch the cervical muscles on the tongue of the ox. Every time of this contact strong contractions are produced in the frog. If a chain of several persons be formed holding hands, the same effect takes place; but the contacts do not produce any effect if the chain of connection be broken or interrupted. Here then we have the most decided substitution of the organized animal system in the place of the metallic pile: it is an animal pile; and the production of the Galvanic fluid, or electricity, by the direct or independent energy of life in animals, can no longer be doubted.

“The Professor has lately repeated the series of these experiments at Oxford, and showed, in the presence of Doctors Pegg and Bancroft, that the nerves of a prepared frog, disposed in the manner here stated, approach very sensibly to the muscles of the warm-blooded animal, and exhibit a real attraction hitherto unknown in natural philosophy and physiology. He invites philosophers to vary and repeat this phænomenon, which has been confirmed by different philosophers, particularly by the celebrated Felice Fontana of Florence. Galvanism, by these facts, is shown to be animal electricity, not merely passive, but most probably performing the most important functions in the animal œconomy. This power appears not to be confined in its operation to the motion of the muscles, but also appears to be of importance in the secretions. Aldini has given strength to this conjecture, by subjecting the urine to the power of the artificial Galvanic stream, and he found it productive of a separation

separation of the principal combined parts of that fluid, which were considered as of much importance by the celebrated Professors Senebier and Jurine, of Geneva.

“ A very ample series of experiments were made by Professor Aldini, which show the eminent and superior power of Galvanism beyond any other stimulant in nature. In the months of January and February last, he had the courage to apply it at Bologna to the bodies of various criminals who had suffered death at that place, and by means of the pile he excited the remaining vital forces in a most astonishing manner. This stimulus produced the most horrible contortions and grimaces by the motions of the muscles of the head and face; and an hour and a quarter after death, the arm of one of the decollated bodies was elevated eight inches from the table on which it was supported, and this even when a considerable weight was placed in the hand. These experiments have since been confirmed

firmed in various parts of Italy, particularly at Turin, by Professors Giulio, Vassali, and Roffi.

“ These are not experiments of pure curiosity, but offer very encouraging prospects for the benefit of mankind, in disorders of the head, and in apoplexies. Professor Aldini means to apply part of his time in London, in communicating these important subjects of information to physicians, as he has already done in Paris, in which place he made some applications of his discoveries, chiefly at the Hospital de Salpetriere, in company with Doctor Pinel *. The application of Galvanism in melancholic insanity is absolutely new, and of great interest. He perfectly cured two patients at Bologna of this disorder ; and on that account he is more desirous of recommending the trial in an affliction so distressing, against which the present system of physic has so little to offer.

* Whose *Treatise sur la Manie* is well known in this country.

“It appears to be equally promising in cases of apoplexy. Aldini thinks it may be highly useful in recovering drowned persons, and on that account he is desirous of communicating with the Society established at London for the recovery of these unfortunate individuals. An experiment lately made at Paris adds much to his expectations. At the Hospital de la Charité he showed the pupils that Galvanism applied to the trunk of a dog, to the spinal marrow, and the intestines, caused the lungs to act in such a manner, that the air that issued from the *aspera arteria* twice in succession extinguished a large candle placed opposite. Now, as in most cases little more is required in drowned subjects than to set the organs of respiration into action, it is to be presumed that the action of Galvanism may be of the highest utility in these cases. Many precautions are necessary to be used in the administration of this powerful remedy in lunacy or apoplexy, which will be detailed in a

large work which Professor Aldini intends to publish in this country before his return to Italy. In the mean time the reader will, doubtless, receive satisfaction from this short notice he has enabled me to give of his labours, on a subject which promises greatly to extend the limits of natural science, and may be reasonably expected to add to the powers which man is enabled to exert for his own benefit over the numerous beings around him."